

MOSQUITO STUDIES (Diptera, Culicidae)

XVII. TWO NEW SPECIES OF DEINOCERITES

FROM COSTA RICA¹

By

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The new species, the first since the review of Belkin and Hogue (1959), are being described here, detached from a general revision of the genus *Deinocerites* by Adames, in order to make the names available for a forthcoming publication by Hogue and Donald B. Bright, California State College, Fullerton, on the biologies of land crabs and their burrow associates in Costa Rica. Most of the material of the new species was collected as part of a worldwide study of tropical land crabs and their burrow associates (LCBA) being conducted by Hogue and Bright with the support of 2 grants from the American Philosophical Society. Additional specimens were obtained through the project "Mosquitoes of Middle America" and also from the project "A Study of the Mammalian Ectoparasites and their Hosts in Costa Rica", the latter supported by the U.S. Army Medical Research and Development Command (DA-MD-49-193-62-G54,G94).

The method of presentation, terminology and abbreviations used in the descriptions follow Belkin (1962), whom we thank for advice. In the figures of immature stages, the hair branching shown is based on the modal values for 8 specimens of *nicoyae* and 10 specimens of *costaricensis*.

Deinocerites nicoyae Adames & Hogue, n.sp.

Figs. 1-3

TYPES: *Holotype* ♂ with associated larval and pupal skins and genitalia slide (CR 254-21), Estero El Mero, Boca del Rio Barranca, Puntarenas Province, Costa Rica, 11 Feb 1969, C.L. Hogue and D.B. Bright [USNM]. *Allotype* ♀ with associated pupal skin (254-100), same data as holotype [USNM]. *Paratypes*: 5 1p♂ (CR 254-23,25,32,34,49), 2 p♂ (254-101,104), 2 IP (254-18,52), 157 L, 1 I (254), same data as holotype [BM,LACM,UCLA,USNM].

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FEMALE (fig. 1). Wing: 2.79 mm. Proboscis: 1.69 mm. Forefemur: 1.61 mm. Abdomen: about 2.83 mm. Small species. *Head*: Integument uniformly dark; narrow decumbent scales of vertex dark brown; erect scales brown to dark brown, lateral patch of scales whitish. Clypeus dark. Labium and palpus dark scaled. Antenna dark; flagellar segment 1 with scales, subequal to combined length of segments 2, 3 and two-thirds of 4, other segments not markedly elongate; proboscis extending to 8th flagellar segment; torus dark. *Thorax*: Mesonotal integument dark, strongly contrasting with very distinctly lighter portions of the pleural integument. Postnotum usually with a few hairs. *Apn* with light brown integument anteriorly, remainder light; upper *ppn* with dark scales and bristles, middle and lower areas light and with 1 to 3 small hairs; *ppl* with brown integument and several bristles; *psp* and *ssp* with dark brown integument, bare; *stp* with dark brown integument, a patch of translucent scales and a row of bristles along dorsal and caudal margins; paratergite dark and bare; *pra* with lighter integument and several bristles; *mep* integument light and without scales, *umep* with several bristles, *lmep* with 1 very strong bristle; 4 or 5 short hairs below base of haltere; meron, metameron and metapleuron light. *Legs*: Anterior surface of forecoxa largely covered by bristles and translucent scales; midcoxa with lateral surface barely darker than adjacent portions of pleuron and with several scales and 2 rows of bristles, the posterior bristles stronger; hindcoxa with lateral surface similar in color to adjacent portion of pleuron and with a few scales and bristles, posterior surface with a row of bristles; femora, tibiae and tarsi entirely dark scaled. Forefemur without spiniforms but with 4 to 6 bristles on anteroventral distal part and with a row of light bristles on posterodorsal side. *Wing*: Vein and fringe scales dark. *Haltere*: Integument of stem light, knob dark scaled. *Abdomen*: Tergites uniformly dark scaled; sternites II-VII about the same color as tergites.

FEMALE GENITALIA (fig. 1). Sternite VIII with a few scales on sclerotized apical part. Tergite IX with 1 or 2 small setae on each side. Cercus without spatulate apical or subapical specialized setae. Postgenital plate with 1 apical specialized seta.

MALE (fig. 1). Wing: 2.91 mm. Proboscis: 1.90 mm. Forefemur: 1.90 mm. Abdomen (not including genitalia): about 1.67 mm. Similar to female in general coloration. Flagellar segments 1-3 with dark scales; segments 1-6 markedly elongated; segment 13 expanded subapically; segment 1 shorter than 2 and 3 combined; proboscis not extending beyond middle of segment 5. Claws of foreleg and midleg subequal, anterior claws with a heavy submedian tooth, posterior claws without tooth.

MALE GENITALIA (fig. 2). *Segment IX*: Tergite lobe cylindrical, broad and angled laterad at base; distal part reaching level of subapical lobe (median mesal lobe of Belkin and Hogue, 1959), directed inwards distally by a distinct deep mesal curvature or constriction, expanded apically. *Sidepiece*: Without scales. Subapical lobe with thumb; ventromesal surface with 3 well-differentiated setae, the most anterior, in dorsal aspect, bristle-like and attenuated apically, the 2 posterior spiniforms rather heavy and without apical attenuation. Apicosternal lobe long, with differentiated apical seta. *Phallosome*: Dorsal parameres widely separated in tergal aspect, caudoventral margin expanded laterad as a broad hemispherical ledge, without sclerotized dorsal bridge; apical spine short, heavy and strongly curved dorsad, visible in toto only in lateral aspect; ventral teeth large, heavy, progressively shorter toward apex and not arising from a distinct lobe. Aedeagus cylindrical, broad mesally then constricted; apex poorly sclerotized but well defined by a subapical necklike constriction.

PUPA (fig. 2). Abdomen: ♀ 3.56 mm; ♂ 3.34 mm. Trumpet: 0.51 mm. Paddle:

0.71 mm. Chaetotaxy as figured. In general similar to other members of the genus; differing in the following diagnostic characters. *Cephalothorax*: Hair 5-C double, strongly developed, longer than distance from its alveolus to base of trumpet, about 1.3 length of trumpet; hair 8-C long, single; hair 9-C short, about one-third to nearly half length of 8-C. *Trumpet*: Index about 4.5-4.6; pinna short. *Metanotum*: Hair 10-C short, smaller than 11-C, usually single. *Abdomen*: Tergal area between hairs 1-I without contrasting pigmentation. Hair 1-II not reaching apex of tergite III, triple, the middle branch longest; hair 5-IV,V barely exceeding the base of succeeding segment; hair 1-VII subequal to tergite VIII. *Paddle*: Width about two-thirds of length; paddle hair (1-P) usually as long as paddle.

FOURTH INSTAR LARVA (fig. 3). Head: 1.05 mm. Siphon: 1.14 mm, index about 4.7-5.3. Chaetotaxy as figured. Similar to other members of genus; with the following diagnostic features. *Head*: Mental plate slightly wider than long, with sharply pointed marginal spicules. Hair 2-C inconspicuous, about 0.2 length of 1-C, either slightly mesad, in line with or laterad of level of 1-C; 3-C not detectable; hair 5-C longer than antenna, usually 4 branched (2-5); 6-C longer than 5-C, single, barbed. *Antenna*: Length about 0.33 of head, shaft with a few minute spicules on proximal part. *Thorax*: Hair 3-P always double; 8-P double; 9-P single; 4-M usually triple (2-4); 6-T short, usually double. *Abdomen*: Hair 3-I longer than 4-I; 6-I-V strong, always double; 6-VI strong, double, branches unequal; 1-IV moderately long, exceeding base of segment V, usually single; 1-VII short, smaller than 3-VII and not reaching base of segment VIII; 1-VIII usually 6 branched (5-7). *Siphon*: As figured; hair 1-S relatively short, triple, branches unequal; pecten with 4 to 6 teeth on each side. *Anal Segment*: Hair 1-X short, double to 5 branched; hair 2-X usually with 5 to 7 branches. Ventral brush (4-X) with 6 pairs of hairs. Gill short, slightly emarginate on apex.

SYSTEMATICS. On the basis of several features of the adults, *nicoyae* falls into the Dyari Group as defined by Belkin and Hogue (1959). The female of this species is apparently indistinguishable from that of *dyari* Belkin & Hogue, 1959, the only other known species of this group. The male of *nicoyae* can be distinguished from *dyari* by the IX tergite lobe reaching the level of the subapical lobe while in the latter it is short and does not reach the level of the lobe. The immature stages of *nicoyae* can be readily separated from *dyari* (at least from Colombian populations) by the following features: (1) in the pupa, hair 5-C double instead of single; hair 1-II triple instead of single; (2) in the larva, ventral brush (4-X) with 6 pairs of hairs instead of 7 pairs; hair 6-III double instead of 3 or 4 branched.

BIONOMICS. *D. nicoyae* has been collected only in the burrows of the Wide Red Land Crab, *Ucides occidentalis* (Ortmann), family Ocypodidae. The immature stages were found on 1 occasion only, when the water level in these burrows was considerably depressed. Occasionally associated with *nicoyae* was *D. pseudus* Dyar & Knab, 1909 which more frequently utilizes the burrows of *Cardisoma crassum* Smith (Gecarcinidae).

DISTRIBUTION. Known to date only from the type locality in Costa Rica and about 3 miles west of same. Material examined: 418 specimens; 151 ♂, 92 ♀, 11 pupae, 167 larvae, 11 individual rearings (3 pupal, 6 larval, 2 incomplete).

COSTA RICA. *Puntarenas*: Boca del Rio Barranca, Estero El Mero, 6 July 1967, C.L. Hogue (CR 238), 2 ♂, 10 ♀, 10 July 1967, C.L. Hogue (CR 240), 58 ♂, 24 ♀ [UCLA]; 10 July 1967; C.L. Hogue (LCBA-188), 69 ♂, 53 ♀ [LACM]; 11 Feb 1969, C.L. Hogue and D.B. Bright (CR 254), 6 lp♂ (254-21,23,25,32,34,49), 2 p♂ (254-101,104), 1 p♀ (254-100), 2 IP (254-18,52), 157 L, 1 I (254) [Type series, USNM,BM,LACM,UCLA]. La Angostura, 7 Nov 1962, J.N. Belkin, C.L. Hogue and W.A. Powder (CR 3); 6 ♂, 3 ♀, 17 Nov 1962, J.N. Belkin, C.L. Hogue and W.A. Powder (CR 27), 8 ♂, 1 ♀ [UCLA].

Deinocerites costaricensis Adames & Hogue, n.sp.

Figs. 4-6

TYPES: *Holotype* ♀ with associated larval and pupal skins (CR 28-213), 1 km north of Boca del Rio Barranca, Hacienda Bonilla, Puntarenas Province, Costa Rica, 17 Nov 1962, C.L. Hogue and W.A. Powder [USNM]. *Allotype* ♂ with associated larval and pupal skins and genitalia slide (CR 28-210), same data as holotype [USNM]. *Paratypes*: 3 lp♀ (CR 28-214,215,218), 3 p♂ (28-201,203,205), 1 p♀ (28-204), 1 IP (28-216), 5 ♂, 3 ♀, 113 L, 3 P, 5 p (CR 28), same data as holotype [BM,LACM,UCLA,USNM].

Deinocerites species A of Belkin and Hogue (1959:438); Hogue and Wirth (1968:6).

FEMALE (fig. 4). Wing 3.98 mm. Proboscis: 2.37 mm. Forefemur: 2.24 mm. Abdomen: about 4.40 mm. Medium-sized species. *Head*: Integument markedly dark; narrow decumbent scales on vertex creamy; erect scales yellowish; lateral patch of scales whitish. Clypeus dark. Antenna with numerous scales on flagellar segment 1 and a few on segment 2, segments 1 to 4 greatly elongated, segment 1 about equal to combined length of segments 2 and one-third of 3; proboscis not extending beyond middle of segment 5; torus dark, with a few short hairs on mesal surface. *Thorax*: Mesonotal integument dark brown. Postnotum without hairs. *Apn* with tan colored integument, anteriorly with a row of strong bristles and posteriorly with a transverse row of less developed bristles; *ppn* tan colored, upper *ppn* with scales and bristles, middle and lower areas with bristles; *ppl* with tan colored integument and numerous bristles; *psp* and *ssp* with brownish integument, bare; *stp* with tan colored integument, completely covered by translucent scales, a row of bristles arranged along dorsal and caudal margins; paratergite brownish and bare; *pra* with several bristles; *mep* with tan colored integument and covered by a patch of translucent scales, *umep* with several bristles, *lmep* without a long bristle; a few short hairs at the base of haltere; meron, metameron and metapleuron with tan colored integument, metameron with several small hairs. *Legs*: Anterior surface of forecoxa largely covered by bristles and scales; midcoxa of the same color as adjacent portions of pleuron, outer surface extensively covered with translucent scales and 2 rows of bristles, the posterior bristles stronger; hindcoxa with integument similar in color to adjacent portions of pleuron, anterolateral surface with translucent scales, lower lateral surface with bristles, upper lateroposterior surface with scales, posterior surface with numerous bristles; femora, tibiae and tarsi dark scaled; forefemur with an anteroventral and posterodorsal row of bristles not modified into spiniforms; hindtibia with a row of spiniforms on the apical two-thirds of dorsal surface. *Wing*: Vein and fringe dark scaled. *Haltere*: Stem light, dorsoapical part with several dark scales; knob dark scaled. *Abdomen*: Tergites dark scaled; sternites II-VII lighter than tergites.

FEMALE GENITALIA (fig. 4). Sternite VIII without scales on sclerotized apical part. Tergite IX with a pair of small setae on each side. Cercus with 6 apical and subapical specialized setae with recurved and twisted apex. Postgenital plate with 1 apical specialized seta.

MALE (fig. 4). Wing: 3.13 mm. Proboscis: 2.71 mm. Forefemur: 2.37 mm. Abdomen (not including genitalia): about 2.79 mm. Similar to female in general coloration. Flagellar segments 1-4 with scales, segments 1-6 markedly elongated; segment 13 slightly expanded subapically; segment 1 shorter than 2 and 3 combined; proboscis not extending beyond the basal part of segment 4. Anterior claw of foreleg with a very long, slender, subbasal tooth, posterior with a minute subbasal projection; an-

terior claw of middle leg with a minute subbasal tooth, posterior claw simple.

MALE GENITALIA (fig. 5). *Segment IX*: Tergite lobe cylindrical, angled laterad from base, broad at base and cone-shaped distally, apical part not strongly attenuated and not reaching level of subapical lobe. *Sidepiece*: Without scales. Subapical lobe with rather small thumb, seta *c* spiniform, with an apical attenuation; ventromesal surface with 3 distinct bristlelike setae, attenuated apically. Apicosternal lobe with differentiated apical seta. *Phallosome*: Dorsal parameres widely separated in tergal aspect but with a slight indication of an incomplete dorsal bridge; apical spine long and slender. Aedeagus cylindrical, more or less uniform in width but with a submedian constriction and an apical expansion on sclerotized part.

PUPA (fig. 5). Abdomen: ♀ 4.07 mm, ♂ 3.62 mm. Trumpet: 0.76 mm. Paddle: 0.84 mm. Chaetotaxy as figured. Similar to other members of genus, with the following diagnostic characters. *Cephalothorax*: Hair 5-C single, moderately long, equal or subequal to distance from its alveolus to base of trumpet, subequal in size to length of trumpet; 4-C single, more than half length of 5-C; 8-C usually triple, subequal to length of trumpet. *Trumpet*: Index about 5.3-7.6; pinna small. *Metanotum*: Hair 10-C well developed, longer than 11-C, single. *Abdomen*: Tergal area between hairs 1-I without contrasting pigmentation. Hair 1-II longer than tergite III, always exceeding the base of tergite IV, double or triple; 5-II mesad to 2-II, hair 5-III-V long, extending as far as middle of second tergite following; hair 1-VII subequal to tergite VIII. *Paddle*: Width more than two-thirds of length; paddle hair (1-P) longer than paddle.

FOURTH INSTAR LARVA (fig. 6). Head: 1.22 mm. Siphon: 1.43 mm, index about 3.8-5.6. Chaetotaxy as figured. In general similar to other members of genus, with the following diagnostic characters. *Head*: Mental plate almost as wide as long and with blunt apical and subapical marginal spicules. Hair 2-C inconspicuous, about 0.25 of length of 1-C, always mesad of level of 1-C; 3-C not detectable; hair 5-C longer than antenna, always double; 6-C longer than 5-C, always single and simple. *Antenna*: Length about 0.33 of head; shaft with numerous minute spicules in proximal part. *Thorax*: Hair 3-P always single; 8-P usually single (1-2); 9-P usually triple (2-3), 4-M usually single (1-2); 6-M moderately long, single. *Abdomen*: Hair 3-I longer than 4-I; 6-I-V strong, double; dorsal sensillum of segment V mesad to hair 4-V; 6-VI strong, single; 1-VII long, longer than 3-VII and exceeding base of siphon; 1-VIII usually 3 branched (3-4); 3-VIII usually 4 branched (4-5). *Siphon*: As figured; hair 1-S moderately long, reaching hair 1a-S, double, branches equal; pecten with 4 to 6 teeth on each side. *Anal Segment*: Hair 1-X short, usually double (1-3); hair 2-X usually 9 branched (6-10). Ventral brush (4-X) with 7 pairs of hairs. Gill long, subequal to dorsal saddle length, slightly emarginate on ventral margin.

SYSTEMATICS. *D. costaricensis* is species A of Belkin and Hogue (1959), which was placed by them in the *Epitedeus* Group. Its closest relative is *epitedeus* (Knab, 1907), which is now known to have a wide distribution along the Caribbean coasts from the Gulf of Honduras to Colombia. The 2 species can be differentiated more easily in the adults than in the immature stages. In *costaricensis* the forefemur has an anteroventral row of bristles which in *epitedeus* are replaced by spiniforms. The male of *costaricensis* can be differentiated from *epitedeus* by the IX tergite lobe being short, cone-shaped and not reaching the level of subapical lobe while in the latter it is long and slender distally and extends beyond the subapical lobe. No diagnostic features have been found so far for the pupa. In the larva, *costaricensis* can be differentiated from *epitedeus* by the following features: (1) hair 7-II is usually 5 branched (3-7) instead of usually double (1-4), (2) the mental plate generally with the terminal spicules blunt instead of sharply pointed.

BIONOMICS. All records of *costaricensis* are from the burrows of the Mouthless Crab, *Cardisoma crassum* Smith (Gecarcinidae). This species appears to be rare compared to *pseudus* which also utilizes these burrows.

DISTRIBUTION. This species is known only from the Pacific coast of Costa Rica; however it has not been found in collections of *Deinocerites* from the outer coast of the Nicoya Peninsula. It may extend farther south along the Pacific coast of Panama. Material examined: 689 specimens; 31 ♂, 41 ♀, 89 pupae, 528 larvae, 38 individual rearings (5 pupal, 23 larval, 10 incomplete).

COSTA RICA. Puntarenas: Boca del Rio Barranca, 31 July 1962, F.S. Truxal, 2 ♂, 3 ♀; 27 June 1967, C.L. Hogue and D.B. Bright (LCBA 111), 3 L; 8 July 1967, C.L. Hogue and D.B. Bright (LCBA 155,156,158-159), 6 L; 11 July 1967, C.L. Hogue and D.B. Bright (LCBA 174), 1 ♀ [UCLA]. Hacienda Bonilla, 1 km north of Boca del Rio Barranca, 17 Nov 1962, C.L. Hogue and W.A. Powder (CR 28), 3 p♂ (28-201,203,205), 1 p♀ (28-204), 1 lp♂ (28-210), 4 lp♀ (28-213,214,215,218), 1 IP (28-216), 5 ♂, 3 ♀, 111 L, 3 P (28-2) [type series, USNM,BM,LACM,UCLA]; 20 June 1963, C.L. Hogue (CR 106,107), 1 ♂ (106), 16 L (107); 21 June 1963, C.L. Hogue (CR 118), 2 ♀. Boca del Rio Baru, 3.5 km northwest, 20 Nov 1962, C.L. Hogue and W.A. Powder (CR 34,43), 2 lp♂ (34-109,114), 5 lp♀ (34-105,106,110,112,115), 1 p♀ (34-101), 6 IP (34-102,103,104,108,111,113), 6 ♂, 9 ♀, 210 L, 5 I, 8 P, 16 p (34), 1 ♂ (43) [UCLA]. Rincon, Peninsula de Osa, 26 June 1963, C.L. Hogue (CR 122-124), 36 L, 1 P (122), 2 lp♂ (123-101,109), 4 lp♀ (123-102,105-107), 1 IP (123-104), 4 ♂, 2 ♀, 9 P, 5 p, 47 L, 4 I (123), 1 ♂ (124); 29 June 1963, C.L. Hogue (CR 130,135-136), 1 I (130, mangrove treehole), 2 lp♂ (135-105,107), 1 IP (135-106), 4 L (135), 2 lp♂ (136-101,103), 1 lp♀ (136-102), 1 IP (136-104); 2 July 1963, C.L. Hogue (CR 142), 5 ♂, 2 ♀, 54 L, 1 I, 4 p (142) [UCLA]. Tarcoles, 1 ♀ [USNM; Belkin and Hogue, 1959:438, as species A].

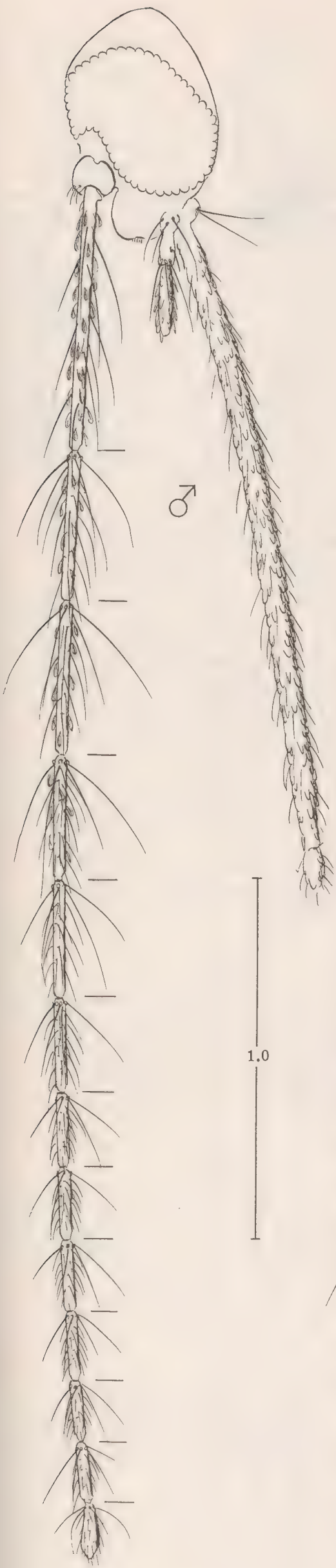
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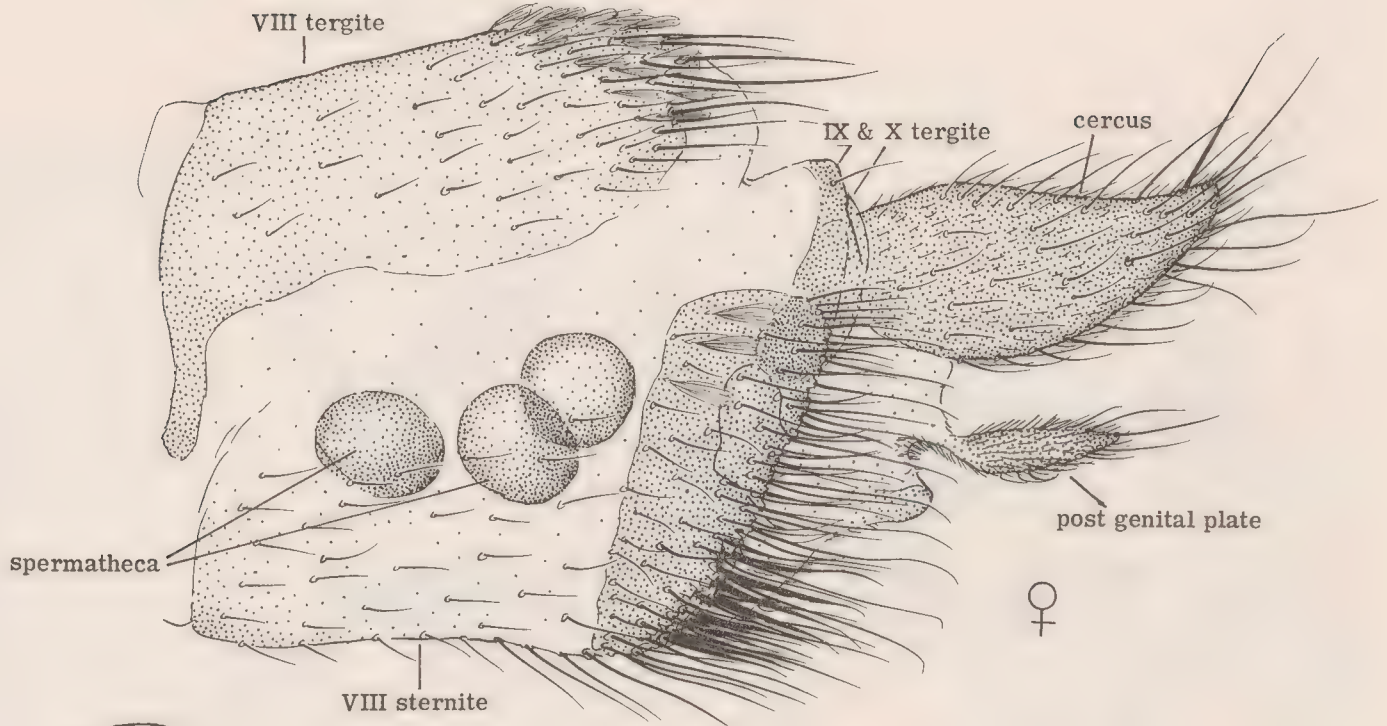
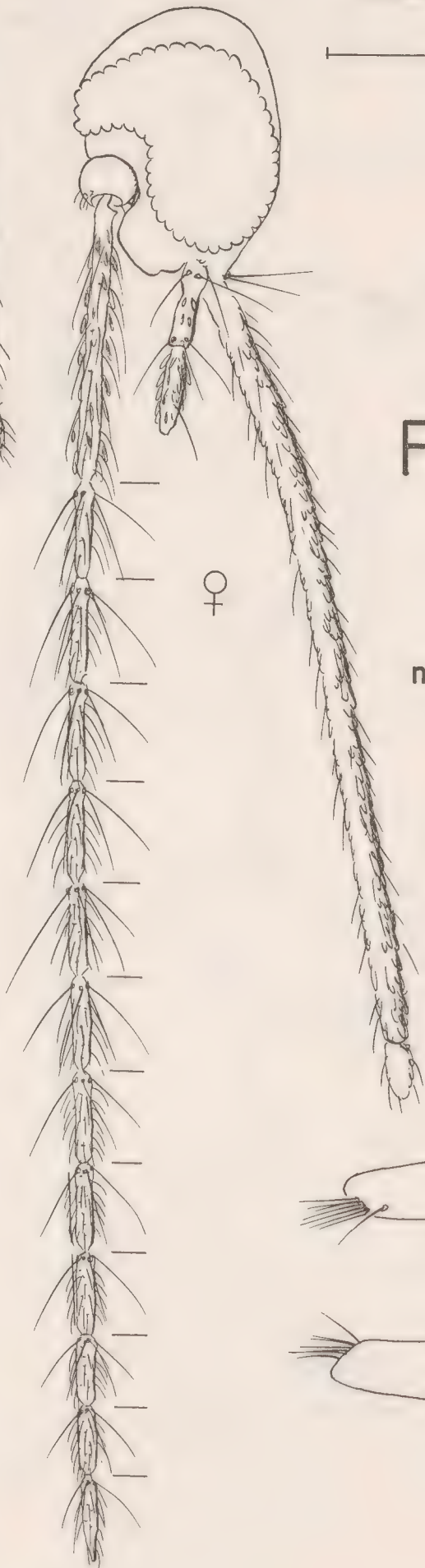
FIGURES

1. *Deinocerites nicoyae*; male and female heads, female genitalia, fore and mid-claws of male, forefemur of female
2. *Deinocerites nicoyae*; male genitalia and pupa
3. *Deinocerites nicoyae*; larva
4. *Deinocerites costaricensis*; male and female heads, female genitalia, fore and midclaws of male, forefemur of female
5. *Deinocerites costaricensis*; male genitalia and pupa
6. *Deinocerites costaricensis*; larva

DEINOCERITES

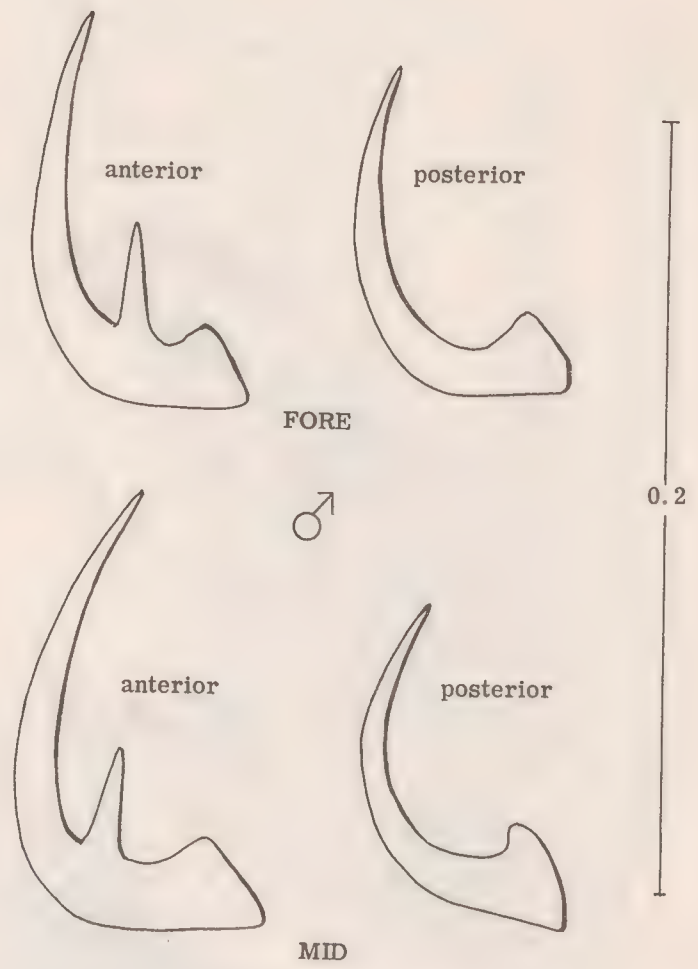


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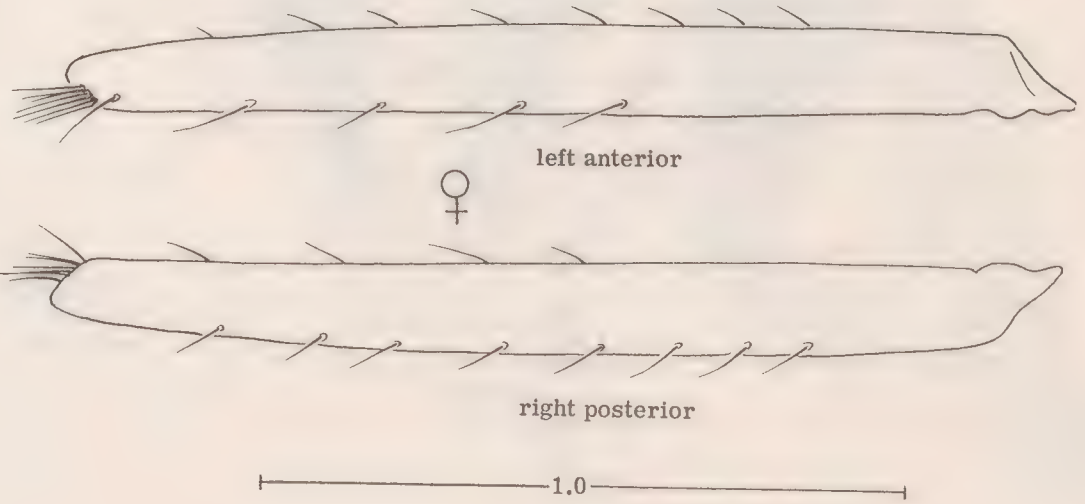


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Fig. 1



nicoyae
LCBA 188



DEINOCERITES

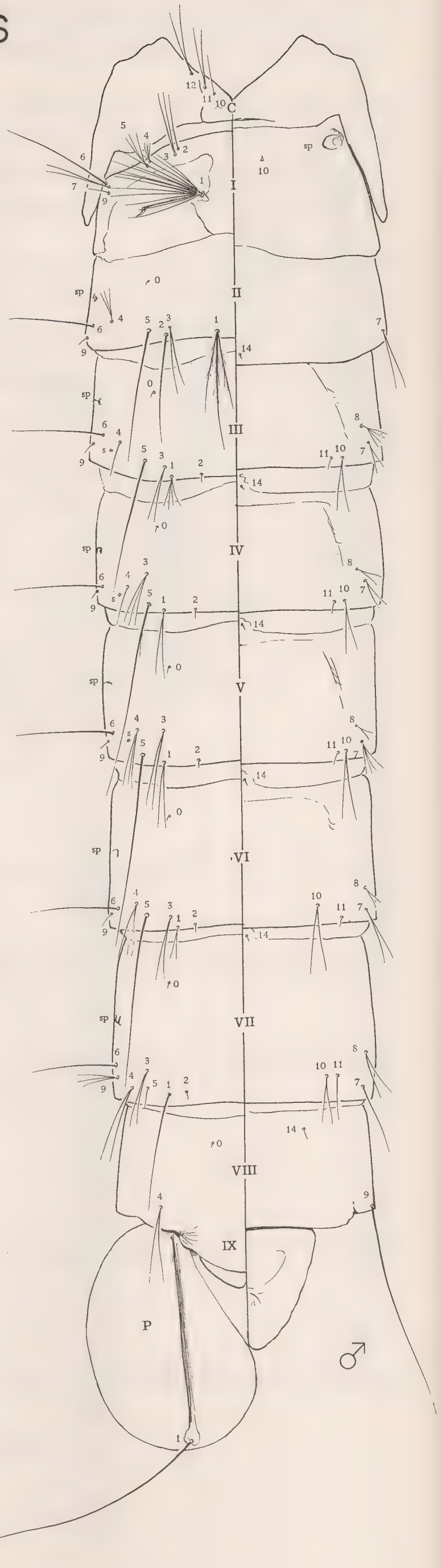
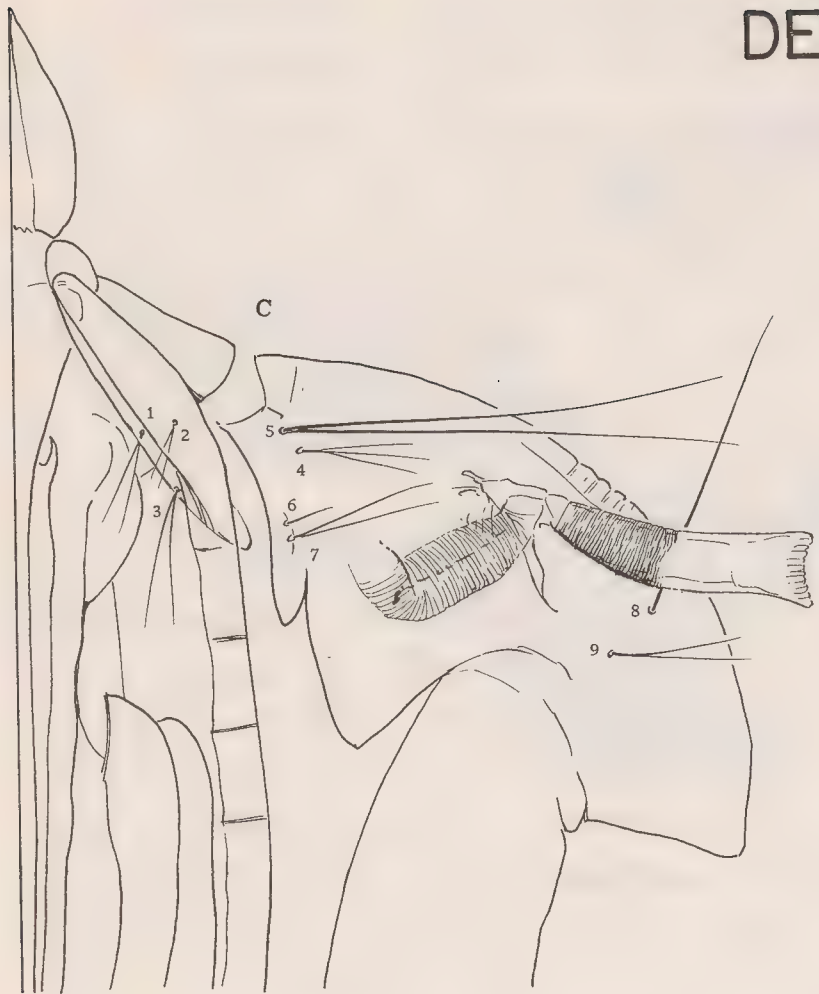
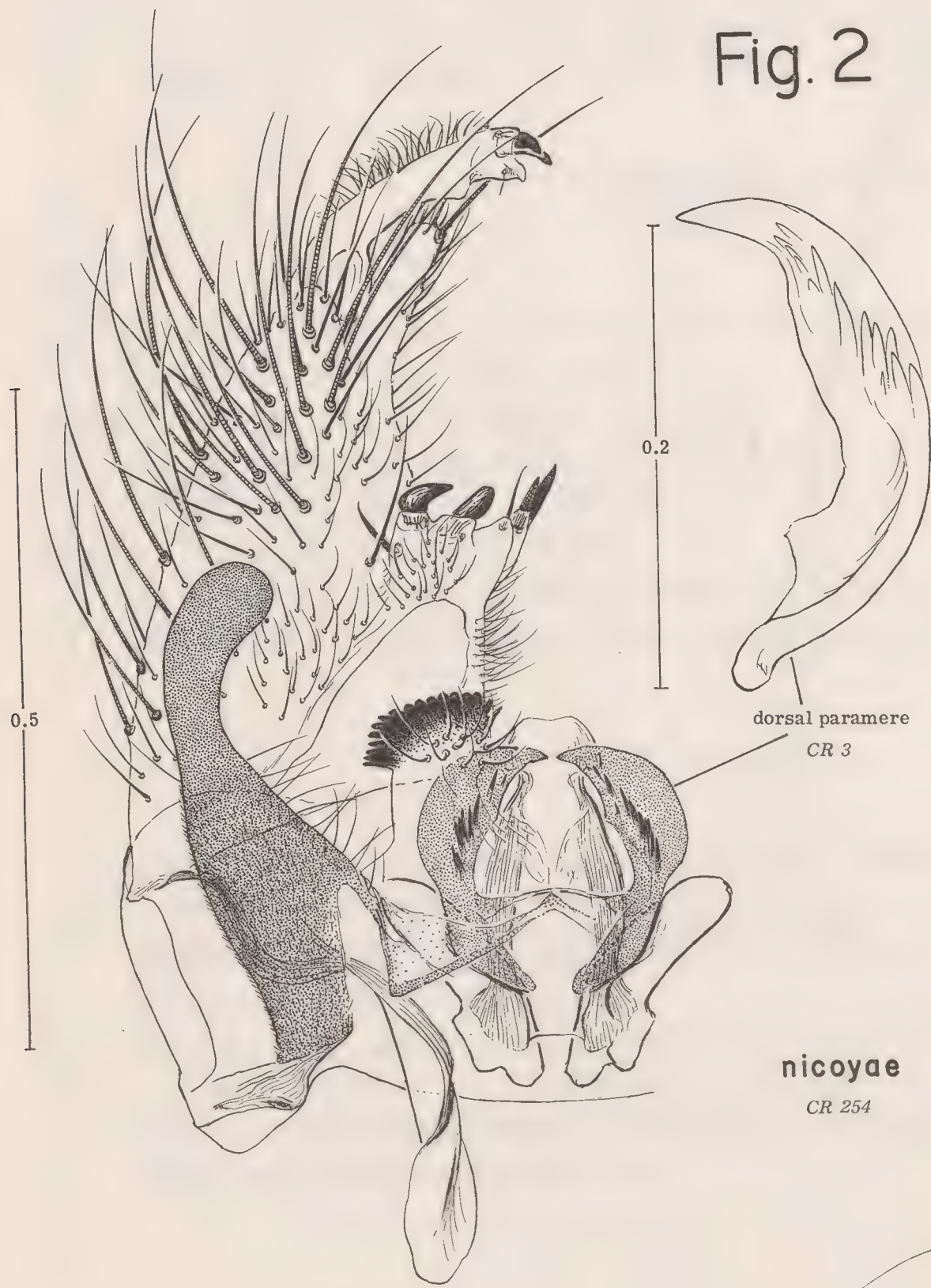


Fig. 2



DEINOCERITES

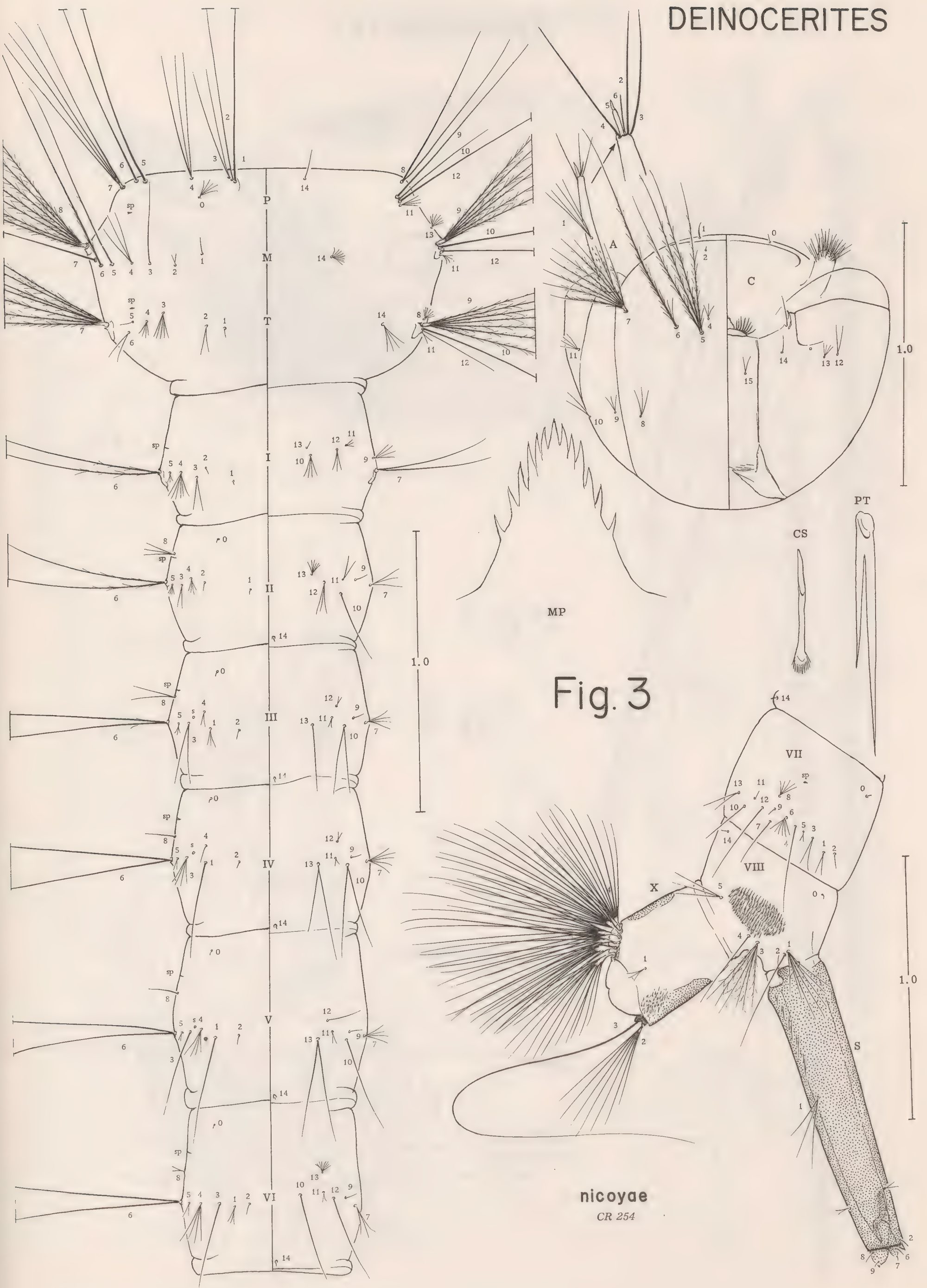


Fig. 3

nicoyae
CR 254

DEINOCERITES

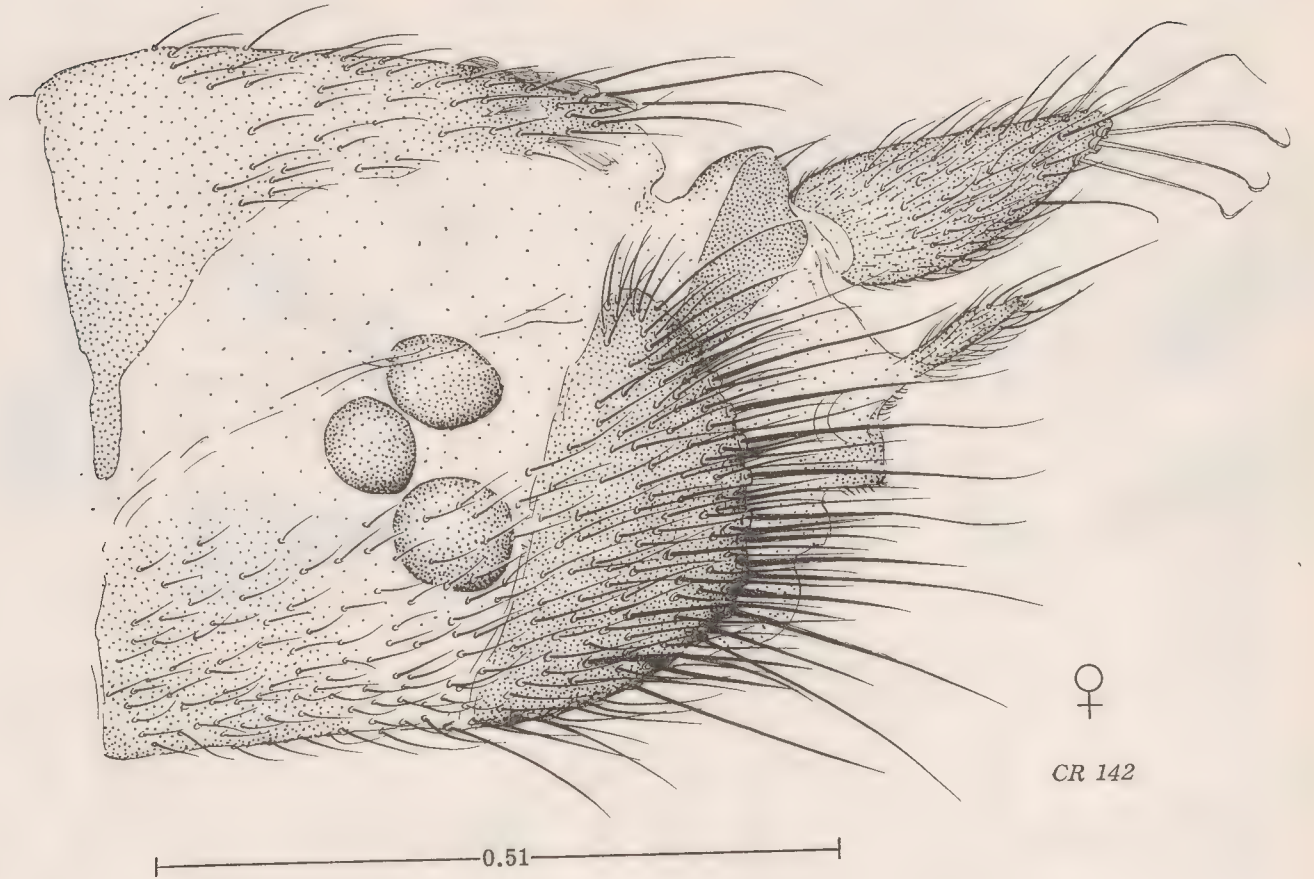
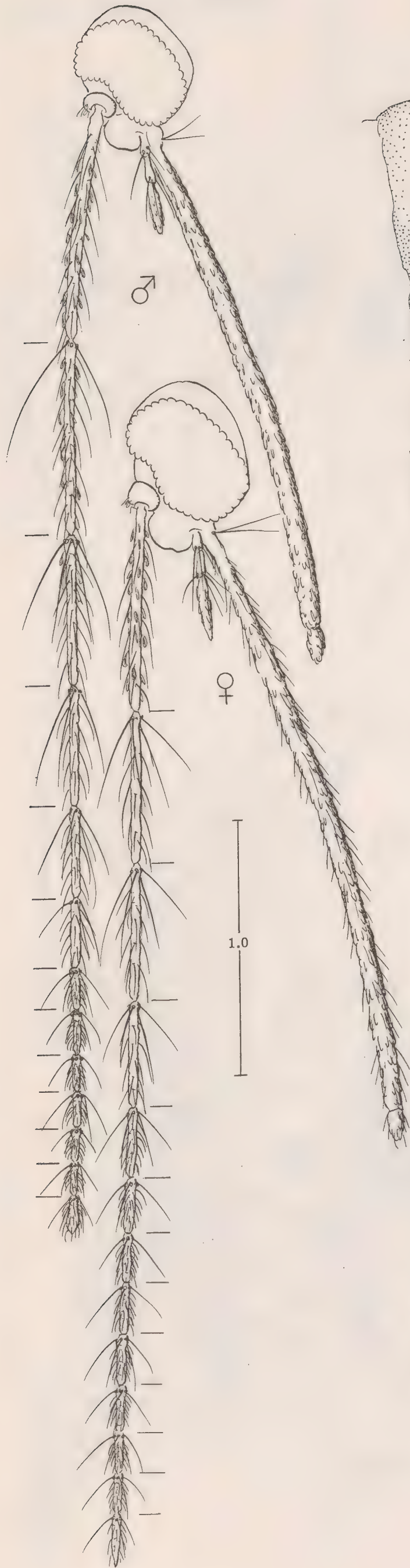
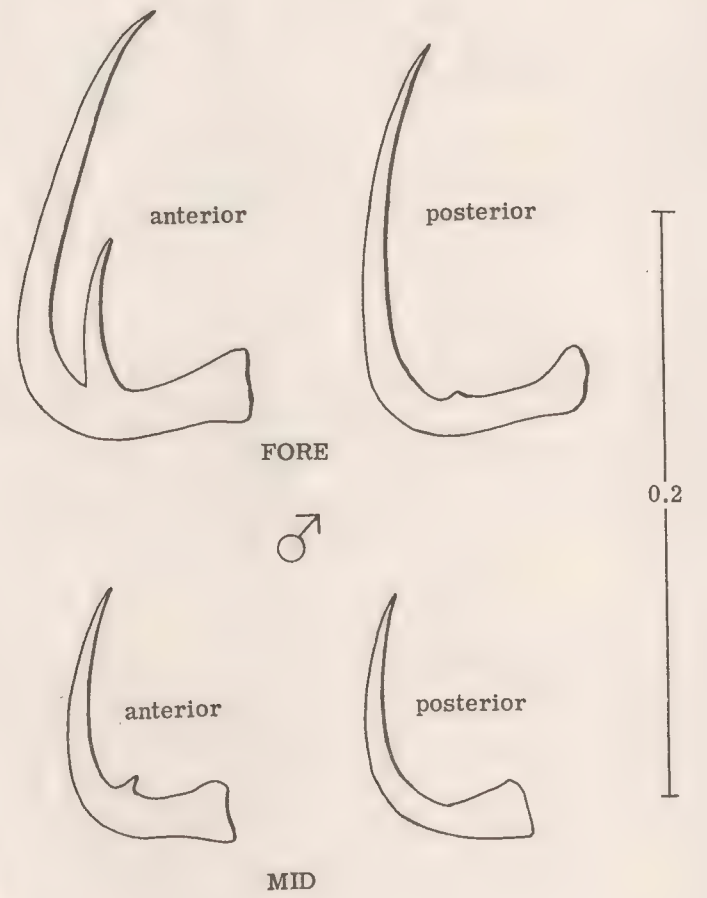
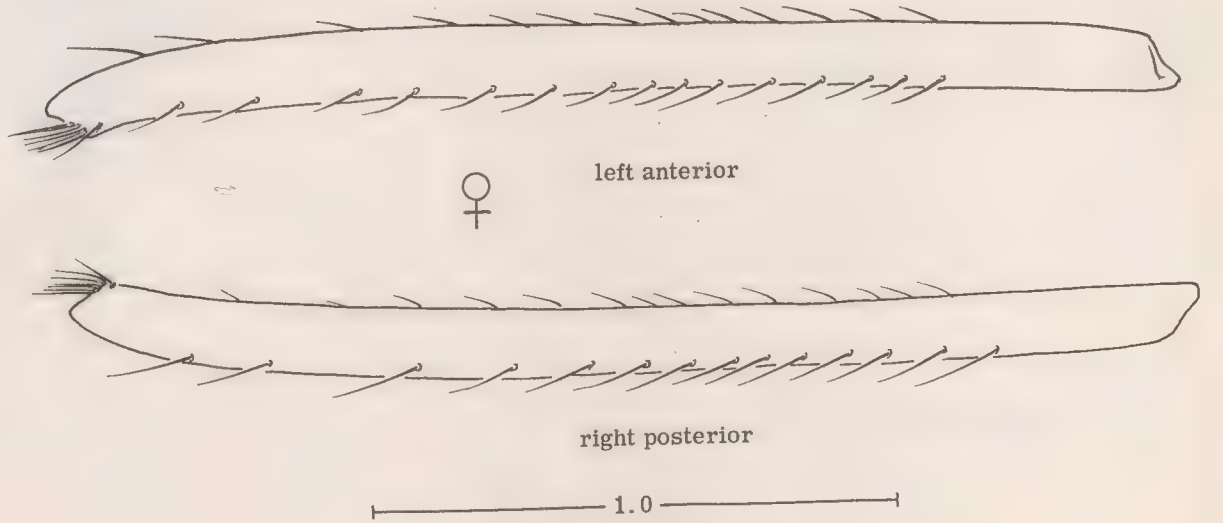


Fig. 4



costaricensis
CR 34



DEINOCERITES

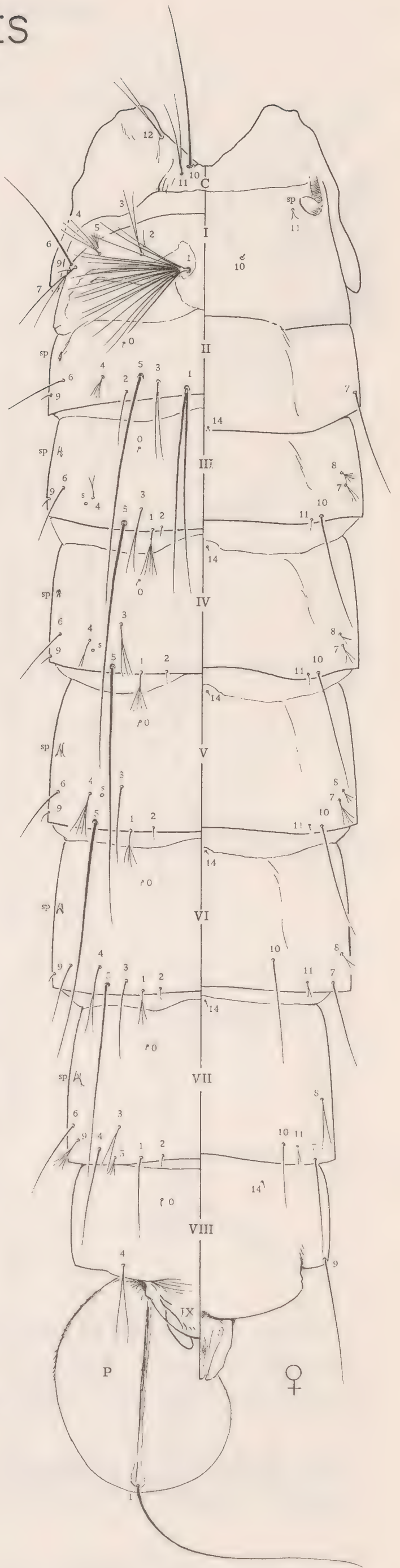
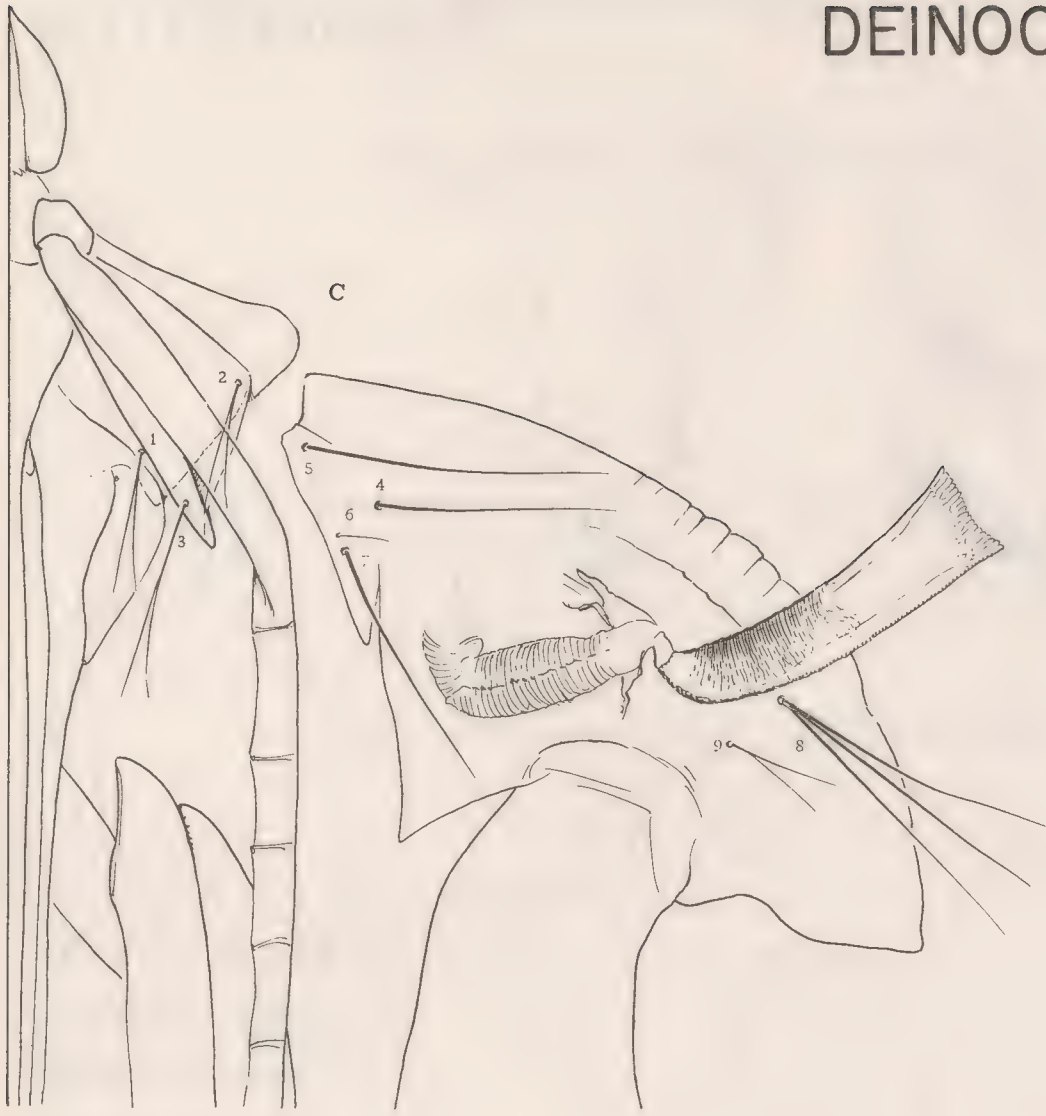


Fig. 5



costaricensis
CR 28

DEINOCERITES

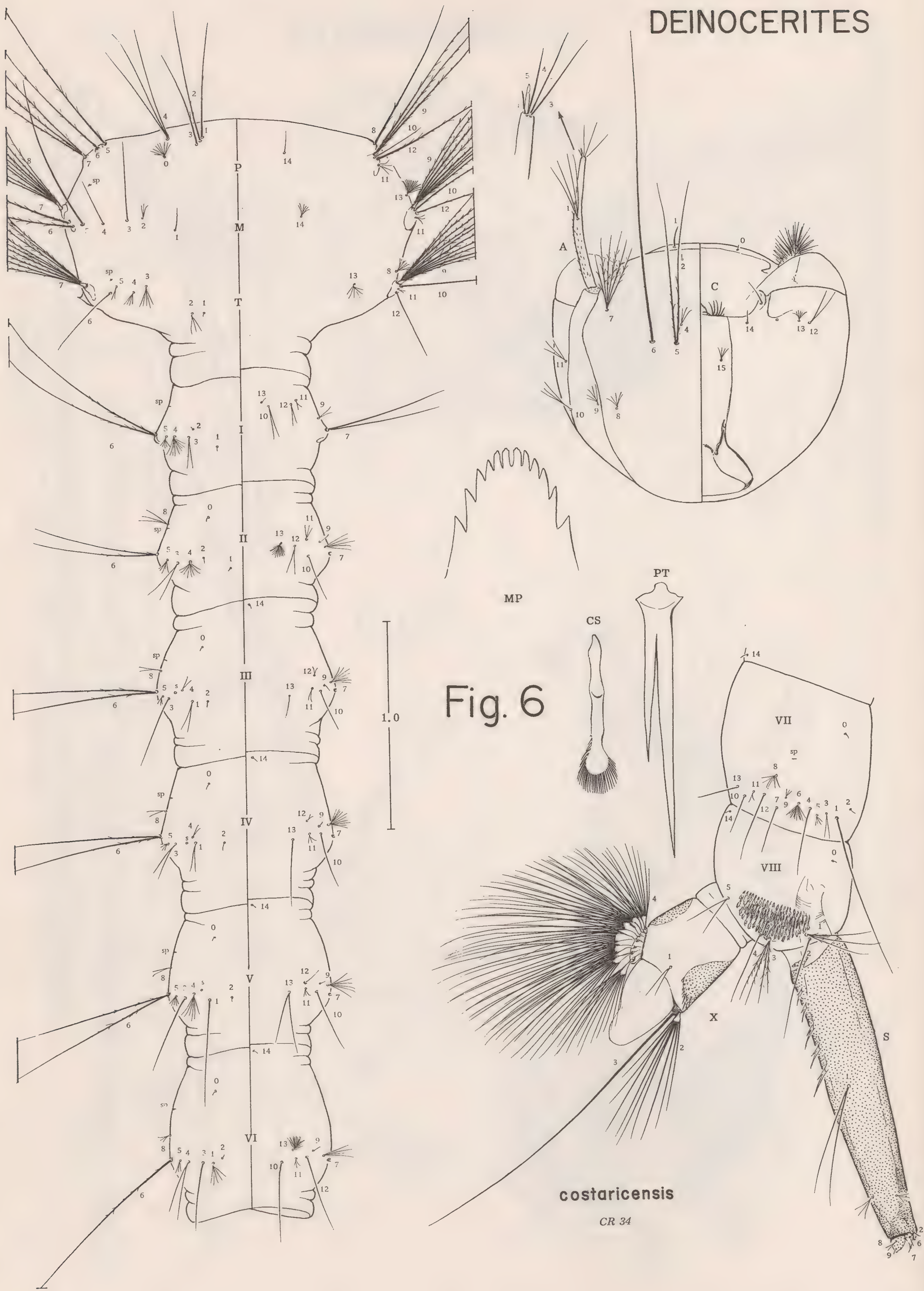


Fig. 6

costaricensis

CR 34